

REMARKS

The subject invention relates to a method and apparatus for optically inspecting features on semiconductor samples. In particular, the invention is addressed to measuring characteristics of single lines or arrays of lines in a grating form. In operation, the sample is measured by illuminating the lines and measuring the light reflected and scattered therefrom. The measurements are compared to a theoretical model corresponding to the sample to determine the characteristics of the structure, including the dimensions of the lines.

An idealized grating is shown in Figure 2 of the instant application. This figure illustrates three longitudinally extending lines. Each of the lines has a rectangular configuration in cross-section. In addition, the edges of the lines, in the longitudinal direction, are straight.

These type of line structures are formed on a semiconductor wafer using lithography techniques including masking and etching. Using such techniques, it is quite difficult to form perfect, vertical sidewalls. In practice, the cross-section shapes of the lines tends to vary from rectangular and are often trapezoidal as illustrated in the Figure 4 of U.S. Patent Publication No. 2004/0070772 (Shchegrov), cited by the Examiner. Accordingly, it was known that the theoretical model used to analyze optical measurement data of such samples must include cross-sectional shapes that deviate from the ideal rectangular cross-sectional shape. Thus, the theoretical model might include trapezoidal cross-sections with rounded edges.

The subject invention is directed to a different issue. More specifically, the subject invention is directed to variations in the longitudinally extending **edges** of the lines. (See the discussion in the subject specification at page 3, line 11.) Current lithography techniques are usually quite successful in creating relatively straight-line edges. However, and as noted in the specification, as the line dimensions have shrunk, roughness is becoming a problem due to molecular size issues. Line edge roughness is illustrated in Figure 3 of the instant application. (Note that in this Figure, the cross-sectional shape is still illustrated as rectangular).

Applicants' invention relates to creating a model that simulates the roughness of the longitudinal edges of the lines. In one set of embodiments as seen in Figures 4 to 6, the line edges are modeled as a series of mesas or holes. As seen in Figure 7, multiple overlapping sets of these holes or mesas can be used. In another embodiment as seen in Figures 8 and 9, the line edges are modeled as periodic functions. It is respectfully submitted that Applicants' invention,

which is directed to modeling and evaluating the roughness of the longitudinal edges of the lines, is not anticipated nor rendered obvious by the prior art.

In the Office Action, the Examiner first noted a numbering error in the claims. The claims have been renumbered to be consistent with the Examiner's proposed numbering scheme.

In the Office Action, the Examiner rejected claims 1 to 5, 12, and 15 to 25 as being anticipated by Shchegrov. The Examiner allowed claims 8 to 11 and objected to claims 6, 7, 13 and 14.

In response, Applicants have added new claims 26 and 27. New claim 26 corresponds to allowable claim 6. New claim 27 corresponds to allowable claim 13.

In addition, Applicants have amended the rejected independent claims to make it more clear that the modeling relates to the longitudinal edges of the lines rather the cross-sectional shape of the lines. As noted above, the problem Applicants are trying to address is completely different from the problem considered in Shchegrov and the solution is different as well. In Shchegrov, the modeling relates to modifications of a rectangular cross-section, to include trapezoids and rounded edges. Applicants' invention is intended to address the variations shown in Figure 3, that is, roughness along the longitudinal side edges of the lines. To solve this problem, one can use models that can include a series of mesas or holes. Alternatively, one can use periodic functions to define the edge. Shchegrov fails to even discuss the longitudinal line edge roughness problem, much less provide a solution. Accordingly, it is respectfully submitted that Shchegrov fails to anticipate or render obvious the amended independent claims.

In the Office Action, the Examiner also indicated that apparatus claims 15 and 25 would not distinguish over Shchegrov in regards to the processor because "it has been held that a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the claimed structural limitations," citing Ex Parte Masham, 2 USPQ F.2d 1647. Applicants traverse this rejection.

Ex Parte Masham (a copy of which is attached for the Examiner's convenience) relates to a claim for a mixer which mixes "flowing developer material." The alleged novelty in the claim was that the mixer itself was immersed in the developer material. The Board upheld the rejection of the claim because the mixer itself was old and the limitations as to its "submerged" location did not support patentability of the mixer.

In contrast, Applicants' apparatus claims include a processor characterized by specific limitations. For example, in claim 15, the processor is programmed to operate to evaluate the sample by comparing measurement data to theoretical data and wherein the theoretical data is generated using a model of the sample, the model including a representation of a line having roughness along a longitudinal edge, the representation being based on a series of overlapping three-dimensional geometrical features. This is not merely an "intended use" but a set of limitations defining the structure processor (e.g. a general purpose processor configured to carry out specific tasks). Surely the Examiner cannot be suggesting that it is proper to make a rejection based on a prior art device having a processor simply because the prior art processor "might" be capable of being programmed in accordance with the limitations of the claims. To support such a rejection, the Examiner must show either that the prior art processor was actually programmed in such a fashion or that it would have been obvious to program the processor in that fashion. The prior art does not support such a conclusion.

For the reasons set forth above, it is respectfully submitted that the claims currently pending in the application define patentable subject matter and allowance thereof is respectfully requested.

Respectfully submitted,

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LEXSEE 2 U.S.P.Q.2D (BNA) 1647

Ex parte Roger D. Masham

Appeal No. 671-94 from Art Unit 152.

Application for Patent filed May 24, 1984, Serial No. 613,686. Mixing Device For
Particulate Material.

Board of Patent Appeals and Interferences

1987 Pat. App. LEXIS 23; 2 U.S.P.Q.2D (BNA) 1647

February 26, 1987, Decided

[*1]

Before Serota, Chairman, and Pellman, Seidleck, Lovell and Steiner, Examiners-in-Chief.

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Primary Examiner - Norman Morgenstern.

Examiner - Kenneth Jaconetty.

OPINIONBY: STEINER

OPINION:

Steiner, Examiner-in-Chief.

This is an appeal from the final rejection of claims 1 through 9. In an amendment submitted on June 24, 1985, claims 2 through 9 were cancelled leaving claim 1. There are no other claims remaining in the application.

Claim 1 reads as follows:

1. An apparatus for mixing flowing developer material, including:
means, defining a chamber, for receiving the flowing developer material therein; and
means for mixing the flowing developer material, said mixing means being stationary and completely submerged in the developer material.

The reference relied upon by the examiner is:
Williams 4,075,977 Feb. 28, 1978

The appealed claims stand rejected under 35 U.S.C. 102(b) as anticipated by Williams. We affirm.

Structurally, the claimed apparatus comprises a chamber and stationary mixing means situated therein. The preambular recitation "for mixing flowing developer [*2] material . . ." and the additional recitation "completely submerged in the developer material" relate to the identity of the material worked upon by the claimed apparatus and the intended manner of employing the claimed apparatus.

Williams discloses an apparatus satisfying the structural requirements of that claimed; i.e., the disclosed apparatus comprises a chamber and a stationary mixing means situated therein. The disclosed apparatus also enjoys the same util-

ity as that claimed; i.e., for mixing flowing developer material. As the only difference between the claimed invention and the apparatus disclosed by Williams, appellant argues that the mixing means of the claimed apparatus is "completely submerged in the developer material"; whereas, in Williams' apparatus, the mixing means is depicted "as only being partially submerged in the developer material" (page 4 of the brief, first full paragraph).

The apparatus disclosed by Williams is employed to mix developer material. Accordingly, the disclosed apparatus satisfies the recitations in claim 1 with respect to the identity of the material intended to be worked upon by the claimed apparatus and the general manner in [*3] which the claimed apparatus is intended to be employed. At any rate, a recitation with respect to the material intended to be worked upon by a claimed apparatus does not impose any structural limitations upon the claimed apparatus which differentiates it from a prior art apparatus satisfying the structural limitations of that claimed. See *In re Rishoi*, 197 F.2d 342, 94 USPQ 71 (CCPA 1952) and *In re Young*, 75 F.2d 996, 25 USPQ 69 (CCPA 1935). Similarly, a recitation with respect to the manner in which a claimed apparatus is intended to be employed does not differentiate the claimed apparatus from a prior art apparatus satisfying the structural limitations of that claimed. See *In re Yanush*, 477 F.2d 958, 177 USPQ 705 (CCPA 1973), *In re Finsterwalder*, 436 F.2d 1028, 168 USPQ 530 (CCPA 1971), *In re Casey*, 370 F.2d 576, 152 USPQ 235 (CCPA 1967) and *In re Otto*, 312 F.2d 937, 136 USPQ 458 (CCPA 1963). In this respect, the examiner has factually determined that Williams' mixing device 40 is capable of being totally submerged in the developer material, since gate member 46 is capable of retaining a supply of developer above the top surface of mixing [*4] device 40. Appellant has not challenged the examiner's factual determination, which determination appears to be based upon sound technical reasoning.

In *In re Pearson*, 494 F.2d 1399, 181 USPQ 641 (CCPA 1974), it was held that a recitation of intended use in a claim directed to a composition does not impose any limitations which differentiates the claimed composition from those which are known in the art. By analogy, the apparatus disclosed by Williams does not undergo a metamorphosis to a new apparatus merely by affixing instructions thereto indicating that a sufficient amount of developer material may be poured into the apparatus to completely submerge the stationary mixing means.

Based upon the foregoing, we agree with the examiner's position that the recitation "completely submerged in the developer material" does not impose any structural limitations upon the claimed apparatus which differentiates it from that disclosed by Williams. We, therefore, agree with the examiner's determination that Williams' apparatus anticipates that claimed within the meaning of 35 U.S.C. 102(b).

AFFIRMED